EASTMAN

Ultrasonic welding
Eastman Tritan™ copolyester
for thin-walled parts

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Like all ultrasonic welding applications, those involving Eastman Tritan™ copolyester may require some optimization. In general, small, thick-walled Tritan parts can be welded by following general practices developed by ultrasonic welder vendors for most amorphous thermoplastics. However, larger diameter, thin-walled Tritan parts may require additional consideration of part design and welding operation. The following suggestions can be viewed as starting points for developing a robust ultrasonic welding process.

Key requirements

Ultrasonic welder

Suggested power requirements

- 2000–4000-watt generator (Power output may vary depending on part size and wall thickness.)
- 15- or 20-kHz converter (Small medical parts may be welded on 30 or 40 kHz.)
- Thin-walled applications using Tritan may require a minimum of 72 microns for 20 kHz or 96 microns for 15 kHz of amplitude to weld (converter × booster × horn).

Welder must be capable of fine tuning adjustments such as:

- Amplitude profiling
- Time or energy mode capability
- Feedback recording is critical for optimizing weld strength.

Joint/part design

- A tongue and groove or step joint with a 60° energy director (measured at apex) is preferred (wall thickness dependent).
- Texturing the mating surface may improve weld strength.
- It is preferred to place the energy director on the horn side for optimization; however, placement on the opposing side should provide a robust weld as well.
- Near-field welding is critical. The distance between the ultrasonic horn and the weld joint should be 0.25 in. or less. If the distance is greater than 0.25 in., design changes will become necessary to accommodate near-field welding requirements.
- Additional weld joint designs, including unique energy directors, may be necessary for a given application and may not be listed within this document.

Figure 1. Joint design

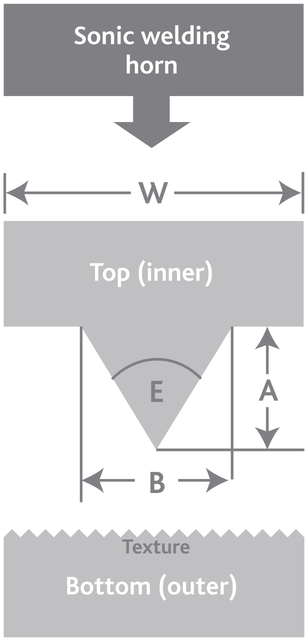


Table 1. Joint design

	Dimension	General guidelines
W	Wall thickness	Preferred greater than 0.080 in.
B	Energy director base width	W/4 to W/5
A	Energy director height	B/2 or minimum of 0.018 in.
E	Energy director angle	Preferred 60°

Textured surface (opposite energy director)

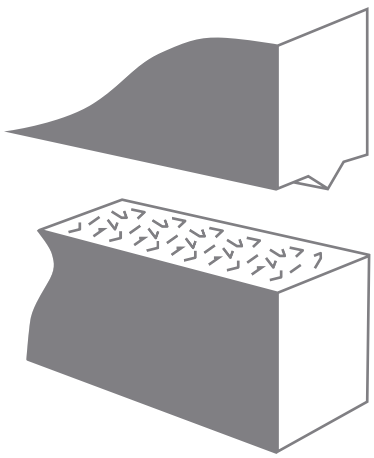
This guideline should be used for implementing a textured surface opposite the energy director.

The textured patterns consist of many small surface projections—3, 4, 5, or 6 mils—molded in the joint surface.

Texturing the surface can provide the following benefits:

- Increases weld strength up to three times
- Reduces flash and particulate matter
- Reduces the total energy required

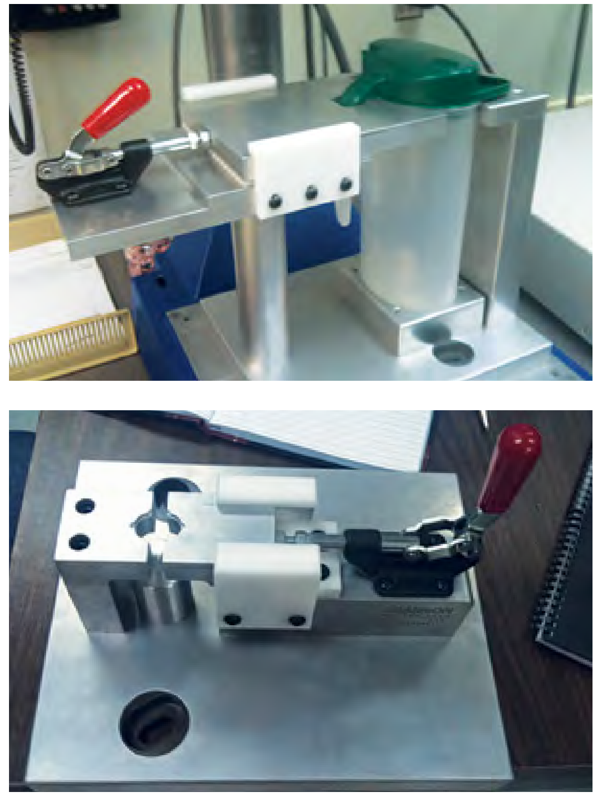
Figure 2. Textured surface joint



Close-up of a typical textured surface joint

Images obtained from www.branson-plastics.com.

Figure 3. Examples of stabilization devices for firmly securing parts during the welding process



Stabilization

- Parts must be stabilized/locked in the sonic welding equipment to ensure proper alignment and to prevent the part from vibrating.
- A vibrating part leads to both poor energy transfer and the potential for the part to move out of alignment.
- Stabilization should be accomplished with a split-fixture clamping system (modified toggle clamp) which:
  - Holds and prevents movement of the outer section of the part
  - Accommodates faster cycle time and prevents part marring
- Fixture devices can be fabricated using any rigid material, such as aluminum.

Ultrasonic welding, though common, is a complex process which requires engagement between the design engineer and welding equipment supplier to achieve successful welds. Tritan is similar to other materials, as the unique properties of the material require application-specific support in optimizing the welding process. Seldom, if ever, will applications be found which merely require tweaks to equipment parameters when changing materials. Common development processes may require part and joint design modifications, changes to fixtures, and alterations to the welding process. As noted, these activities are not unique to Tritan; ***all material changes may require some combination or all of these components.***

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